

## **Remarks**

This Response is to the Final Office Action dated 29 July 2008.

This Response is being filed within the three-month shortened statutory response period indicated by the Final Office Action, so no late fees are required. This Response makes no amendments to the claims. Accordingly, no claims-related fees are required.

### **For the Claims:**

This application was originally filed with claims 1-65. A previous Amendment canceled claims 14, 38-44, and 54.

This Final Office Action rejected all pending claims (i.e., claims 1-13, 15-37, 45-53, and 55-65). The Final Office Action stated three separate grounds of rejection. Sections 1-2 of the Final Office Action rejected claims 1-2, 11-13, 15-16, 18, 20, 22, 24, 29-30, 32-34, 36-37, 45-46, 50, 54, 57-58, 61-63, and 65 under 35 U.S.C. 103(a) as being unpatentable over Rahman et al. (U.S. Pub No. 2003/0174783, hereinafter "Rahman") in view of Jeckeln et al. (U.S. Pub No. 2002/0191710, hereinafter "Jeckeln"). This application includes three independent claims (i.e., claims 1, 30 and 45). Every independent claim in this application has been rejected under the combination of Rahman and Jeckeln.

Sections 3-9 of the Final Office Action rejected claims 3-10, 17, 19, 21, 23, 25-28, 35, 47-49, 51-53, 55-56, 59-60, and 64 under 35 U.S.C. 103(a) as being unpatentable over Rahman in view

of Jeckeln and further in view of Sarca (U.S. Pub No. 2005/0123066). All of these claims are dependent claims. Section 10 of the Final Office Action rejected dependent claim 31 under 35 U.S.C. 103(a) as being unpatentable over Rahman in view of Jeckeln and further in view of Rafie et al. (U.S. Pub. No. 2003/0058959). Applicant respectfully requests reconsideration.

**Rahman:**

The Final Office Action alleges that Rahman essentially teaches all but one of the limitations recited in each of applicant's independent claims.

Rahman discloses a transmit path correction system that corrects for one form of linear distortion in a transmit path of a transmitter. In particular, Rahman corrects for quadrature imbalance. Rahman fails to address other forms of linear distortion, such as frequency response distortion, which results from the use of filters whose transfer functions invariably apply different amounts of gain at one edge of the signal bandwidth than is applied at the other edge of the signal bandwidth. Such filters are typically included in upconversion chains after RF modulation, surrounding a power amplifier, and in other locations. The Rahman reference fails to disclose such filters, and extracts a baseband feedback signal from the transmit path to use in correcting for quadrature imbalance. Such filters that are present at RF insert linear distortion that cannot be removed by the Rahman system because the Rahman feedback signal is extracted upstream of such RF components.

Accordingly, Rahman does a poor job of compensating for linear distortion. But, compensating for all linear distortion is not the problem to which the Rahman system is directed.

Rather, Rahman is directed only to the problem of quadrature imbalance correction.

The Final Office Action acknowledges that Rahman fails to teach of "a digital-subharmonic-sampling downconverter," as recited in each of applicants' independent claims, to process its feedback signal.

**Jeckeln:**

The Final Office Action alleges that Jeckeln teaches of a complex digital sampling down converter functionally equivalent to the claimed digital-subharmonic-sampling downconverter. This is incorrect.

Jeckeln teaches of a predistortion device that uses a digital receiver. The Jeckeln predistortion device is addressed to the problem of linearizing a power amplifier (PA) 34. In other words, Jeckeln teaches a technique for applying nonlinear predistortion in an RF IQ modulator 46 so that the output from PA 34 appears more linear, not the linear predistortion that is the subject of applicants' claims. Jeckeln discloses no structure whatsoever addressed toward linear predistortion. Jeckeln discloses that the feedback signal is not phase-coherent with the forward RF signal processed through IQ modulator 46 and power amplifier (PA) 34. And, Jeckeln uses out-of-band energy in a feedback loop that applies nonlinear predistortion at IQ modulator 46 in a way intended to attenuate the out-of-band energy.

In addressing the nonlinear predistortion problem, Jeckeln teaches of extracting RF signals at the input and output of PA 34, and then performing RF translation "down to within an alias-

free sampling range from DC up to 35 MHz" (Jeckeln, paragraph [0066]). RF translators which translate from RF to IF are well known in the art. They perform a downconversion. The RF translators 50 and 56 should include an IF filter at the output of the RF translators, between the downconversion operation and the A/D operation, in order to eliminate an unwanted sideband and achieve the "alias-free sampling range from DC up to 35 MHz" that Jeckeln calls for. It would also be conventional for the RF translators 50 and 56 to also include an RF filter prior to the downconversion operation to reduce intermodulation products in the band of interest.

Following the analog downconversion in RF translators 50 and 56, Jeckeln performs a conventional Nyquist-rate sampling operation in digital receivers 54 and 60 in converting the frequency-translated signals from RF translators 50 and 56 into digital streams. An analog-to-digital conversion operation is performed in digital receivers 54 and 60, and a conversion from a combined signal into two reduced-rate complex signal streams is performed in digital receivers 54 and 60. Jeckeln indicates that "a sampling rate of 70 MHz is adequate" (Jeckeln, paragraph [0066]), which meets the requirements of the Nyquist sampling rate for the DC to 35MHz band of interest.

Accordingly, the goal of Jeckeln is to perform alias-free Nyquist sampling, which requires the use of filters in RF translators 50 and 56. Jeckeln performs no subharmonic sampling.

**Independent Claims 1, 30, and 45:**

Independent claim 1 recites a limitation of "a complex-digital-subharmonic sampling downconverter". Independent claim 30 recites a limitation of "a digital-subharmonic sampling

downconverter". And, independent claim 45 recites a limitation of "a digital-subharmonic-sampling downconverter".

The Final Office Action acknowledges that the primary reference, Rahman, fails to teach of such limitations. As discussed above, the secondary reference, Jeckeln, likewise fails to teach of such limitations. Jeckeln fails to teach of such limitations because Jeckeln fails to teach of any subharmonic sampling. The Final Office Action even acknowledges that Jeckeln fails to teach of these limitations of independent claims 1, 30, and 45 by gratuitously, and incorrectly, alleging that the feedback downconversion path taught by Jeckeln is "functionally equivalent" to that which is recited in applicant's claims. As is discussed below, this "functionally equivalent" allegation is incorrect. But not only is the "functionally equivalent" allegation incorrect, the "functionally equivalent" standard is an improper standard to use in examining combinations of references for making allegations of obviousness.

No combination of Rahman and Jeckeln can result in a system that incorporates applicant's recited digital-subharmonic-sampling downconverter limitation because neither Rahman nor Jeckeln teach of such a thing. Accordingly, the combination of Rahman and Jeckeln fail to render applicant's claims 1, 30, and 45 obvious. Reconsideration is respectfully requested.

But there is more to consider supporting the impropriety of using the Rahman and Jeckeln references against applicant's claims 1, 30, and 45. In particular, the conventional analog downconversion followed by digital sampling and complex conversion as taught by Jeckeln is far from being equivalent to applicant's claimed digital-subharmonic sampling downconverter.

Rather, it is inferior to applicant's claimed digital-subharmonic sampling downconverter for the purposes of applying linear predistortion. As discussed above, Jeckeln's RF translators 50 and 56 introduce linear distortion. The linear distortion is introduced primarily, but not entirely, by the inclusion of an IF filter within RF translators 50 and 56 to remove an unwanted sideband from the analog downconversion and achieve the "alias-free sampling range from DC to 35 MHz" to which Jeckeln refers. This filter will typically be of a low-pass variety and will introduce a different (i.e., lower) gain at the 35 MHz end of the Jeckeln frequency band of interest when compared to the gain at the DC end of the Jeckeln frequency band of interest. The gain slope over the band of interest is a form of linear distortion.

When such linear distortion is not present in the signal at the output of PA 34 but is first introduced in the feedback signal that drives a linear predistorter, the linear predistorter will act as though it was in the signal at the output of PA 34 and attempt to correct for it. As a result, assuming the predistorter is working correctly, it will compensate for a linear distortion that does not exist at the output of PA 34 and actually worsen linear distortion at the output of PA 34.

One skilled in the art would not combine the teaching of Jeckeln, which does nothing to address linear distortion, with the teaching of Rahman, which does a poor job of compensating for linear distortion because Rahman is concerned with only with compensating for quadrature imbalance, to result in applicant's invention as claimed in claims 1, 30, and 45. As discussed above, applicant's invention as claimed in claims 1, 30, and 45 recites structure that is not taught in either of Rahman or Jeckeln, so no such combination can result in applicant's claimed

invention. But the resulting combination will also do a poor job of compensating for linear distortion because, among other reasons, it introduces linear distortion in the feedback signal path. The insertion of such linear distortion may be avoided through the use of applicant's claimed digital-subharmonic sampling downconverter. Reconsideration is respectfully requested.

**Dependent Claims 2, 11-13, 15-16, 18, 20, 22, 24, 29, 32-34, 36-37, 46, 50, 54, 57-58, 61-63, and 65:**

Dependent claims 2, 11-13, 15-16, 18, 20, 22, 24, 29, 32-34, 36-37, 46, 50, 54, 57-58, 61-63, and 65 were rejected as being obvious over the combination of Rahman and Jeckeln.

Claims 2, 11-13, 15-16, 18, 20, 22, 24, and 29 depend, directly or indirectly, from independent claim 1. Applicant does not agree with all the separate allegations made in the Final Office Action about each of claims 2, 11-13, 15-16, 18, 20, 22, 24, and 29. Applicant reserves the right to present arguments and explanations which further detail separate reasons why claims 2, 11-13, 15-16, 18, 20, 22, 24, and 29 should be found allowable over the combination of Rahman and Jeckeln in an Appeal, should an Appeal become necessary. But even without considering such separate reasons, claims 2, 11-13, 15-16, 18, 20, 22, 24, and 29 are allowable at least due to their dependency on claim 1. Reconsideration is respectfully requested.

Claims 32-34, and 36-37 depend, directly or indirectly, from independent claim 30. Applicant does not agree with all the separate allegations made in the Final Office Action about each of claims 32-34, and 36-37. Applicant reserves the right to

present arguments and explanations which further detail separate reasons why claims 32-34, and 36-37 should be found allowable over the combination of Rahman and Jeckeln in an Appeal, should an Appeal become necessary. But even without considering such separate reasons, claims 32-34, and 36-37 are allowable at least due to their dependency on claim 30. Reconsideration is respectfully requested.

Claims 46, 50, 54, 57-58, 61-63, and 65 depend, directly or indirectly, from independent claim 45. Applicant does not agree with all the separate allegations made in the Final Office Action about each of claims 46, 50, 54, 57-58, 61-63, and 65. Applicant reserves the right to present arguments and explanations which further detail separate reasons why claims 46, 50, 54, 57-58, 61-63, and 65 should be found allowable over the combination of Rahman and Jeckeln in an Appeal, should an Appeal become necessary. But even without considering such separate reasons, claims 46, 50, 54, 57-58, 61-63, and 65 are allowable at least due to their dependency on claim 45. Reconsideration is respectfully requested.

**Dependent Claims 3-10, 17, 19, 21, 23, 25-28, 35, 47-49, 51-53, 55-56, 59-60, and 64.**

Dependent claims 3-10, 17, 19, 21, 23, 25-28, 35, 47-49, 51-53, 55-56, 59-60, and 64 were rejected as being obvious over the combination of Rahman, Jeckeln and Sarca. Rahman and Jeckeln were discussed above. Sarca teaches nothing to further the teaching of Rahman and Jeckeln with respect to the "digital-subharmonic sampling downconverter" limitation of applicant's independent claims 1, 30, and 45 and has no bearing on the allowability of independent claims 1, 30, and 45. Accordingly,



independent claims 1, 30, and 45 are allowable over the Sarca reference, alone or in combination with Rahman and Jeckeln.

Claims 3-10, 17, 19, 21, 23, and 25-28 depend, directly or indirectly, from independent claim 1. Applicant does not agree with all the separate allegations made in the Final Office Action about each of claims 3-10, 17, 19, 21, 23, and 25-28. Applicant reserves the right to present arguments and explanations which further detail separate reasons why claims 3-10, 17, 19, 21, 23, and 25-28 should be found allowable over the combination of Rahman, Jeckeln, and Sarca in an Appeal, should an Appeal become necessary. But even without considering such separate reasons, claims 3-10, 17, 19, 21, 23, and 25-28 are allowable at least due to their dependency on claim 1. Reconsideration is respectfully requested.

Claim 35 depends from independent claim 30 by way of claim 34. Applicant does not necessarily agree with the allegations made in the Final Office Action about claim 35. Applicant reserves the right to present arguments and explanations which further detail separate reasons why claim 35 should be found allowable over the combination of Rahman, Jeckeln, and Sarca in an Appeal, should an Appeal become necessary. But even without considering such separate reasons, claim 35 is allowable at least due to its dependency on claim 30. Reconsideration is respectfully requested.

Claims 47-49, 51-53, 55-56, 59-60, and 64 depend, directly or indirectly, from independent claim 45. Applicant does not agree with all the separate allegations made in the Final Office Action about each of claims 47-49, 51-53, 55-56, 59-60, and 64. Applicant reserves the right to present arguments and

explanations which further detail separate reasons why claims 47-49, 51-53, 55-56, 59-60, and 64 should be found allowable over the combination of Rahman, Jeckeln, and Sarca in an Appeal, should an Appeal become necessary. But even without considering such separate reasons, claims 47-49, 51-53, 55-56, 59-60, and 64 are allowable at least due to their dependency on claim 45. Reconsideration is respectfully requested.

**Dependent Claim 31:**

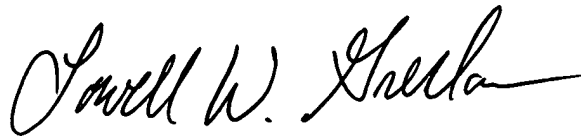
Dependent claim 31 was rejected as being obvious over the combination of Rahman, Jeckeln and Rafie et al. Rahman and Jeckeln were discussed above. Rafie et al. teaches nothing to further the teaching of Rahman and Jeckeln with respect to the "digital-subharmonic sampling downconverter" limitation of applicant's independent claims 1, 30, and 45 and has no bearing on the allowability of independent claims 1, 30, and 45. Accordingly, independent claims 1, 30, and 45 are allowable over the Rafie et al. reference, alone or in combination with Rahman and Jeckeln.

Claim 31 depends from independent claim 30. Applicant disagrees with the allegations made in the Final Office Action about claim 31 and the interpretation of Rafie et al. Applicant reserves the right to present arguments and explanations which further detail separate reasons why claim 31 should be found allowable over the combination of Rahman, Jeckeln, and Rafie et al. in an Appeal, should an Appeal become necessary. But even without considering such separate reasons, claim 31 is allowable at least due to its dependency on claim 30. Reconsideration is respectfully requested.

**Conclusion:**

Applicant believes that the foregoing amendments and remarks are fully responsive to the rejections recited in the 29 July 2008 Final Office Action and that the present application is now in a condition for allowance. Accordingly, reconsideration of the present application is respectfully requested.

Respectfully submitted,

A handwritten signature in black ink, reading "Lowell W. Gresham", written in a cursive style. The signature is positioned above a horizontal line.

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